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FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
Or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
For
CHELTON FLIGHTLOGIC EFIS-SV as installed in

_____
Make and Model Airplane

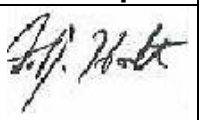
Registration Number _____

Serial Number _____

This document serves as an Airplane Flight Manual Supplement or a Supplemental Airplane Flight Manual when the aircraft is equipped with the Chelton FlightLogic EFIS-SV system. This document must be carried in the airplane at all times when the EFIS is installed in accordance with Supplemental Type Certificate No. SA02203AK. The information contained in this document supplements or supersedes the information made available to the operator by the manufacturer in the form of clearly stated placards, markings, or manuals as required by CAR 3.777(b) or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic placards, markings, or manuals or the basic FAA approved Airplane Flight Manual.

FAA Approved: _____
Manager, Anchorage Aircraft Certification Office
Federal Aviation Administration
Anchorage, Alaska
Date: December 19, 2003

Revision Record

Rev.	Notes	Date	FAA Aprv.
B	1. Add description of AIU autopilot and CDI signals. 2. Clarify description of primary and secondary installations in GENERAL section. 3. Add secondary installation guidance to GENERAL, NAVIGATION, EMERGENCY PROCEDURES and ABNORMAL PROCEDURES sections. 4. Add discussion of dead reckoning errors to ABNORMAL PROCEDURES section. 5. Add description of system toggle switches in SYSTEM ANNUNCIATORS/SWITCHING section. 6. Add Auxiliary Sensor failure guidance in ABNORMAL PROCEDURES section.	12/19/03	
A	Initial Release.	03/27/03	G. Holt

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1.0 GENERAL

The Chelton FlightLogic EFIS-SV ("EFIS") equipment has been certified to TSO C-146a Class Gamma 1 and complies with AC20-138a for navigation using GPS and WAAS (within the coverage of Space-based Augmentation system complying with ICAO Annex 10) for enroute, terminal area, and non-precision approach operations (including "GPS" or "GPS and RNAV" approaches).

The EFIS is a complete flight and navigation instrumentation system that provides information to the pilot via the Integrated Display Unit (IDU). The IDU can be configured as a Primary Flight Display (PFD), or a Multi-Function Display (MFD) depending on installation. The PFD is a three-dimensional, enhanced situational awareness display that provides forward-looking terrain, attitude, altitude, airspeed, vertical speed, direction, and Highway-in-the-Sky navigation. The MFD can display a moving map, traffic, terrain, weather, HSI or a combination thereof.

The EFIS provides visual and aural warnings, cautions, and advisories for system monitoring. Warnings consist of a red flag on the IDU and a voice warning that repeats until acknowledged by the pilot. Cautions consist of an amber flag on the IDU and a one-time voice report or chime. Advisories can consist of an amber or green flag depending on condition, and a single voice report or chime.

A primary installation consists of at least one IDU permanently assigned as the PFD and up to three additional IDUs assigned as PFD/MFD, up to two Air Data Computers (ADC), up to two Global Positioning System (GPS) receivers, up to two Attitude and Heading Reference Systems (AHRS) units, with reversionary switching as needed. The PFD must be mounted within the pilot's primary field of view. As the PFD contains a CDI and is within the pilot's primary field of view, a primary installation may be IFR approved for GPS and WAAS navigation without the installation of an Analog Interface Unit (AIU) or external CDI.

A secondary installation consists of at least one IDU permanently assigned as PFD/MFD, up to two Air Data Computers (ADC), up to two Global Positioning System (GPS) receivers, and up to two Attitude and Heading Reference Systems (AHRS) units mounted in the radio rack with reversionary switching as needed. Standard primary flight instrumentation is retained in a secondary installation. In order for this installation to be IFR approved for GPS and WAAS navigation, an Analog Interface Unit (AIU) powering a CDI in the pilot's primary field of view must be installed.

Each IDU contains all necessary hardware, software, and databases and operate independently of the other IDUs installed. The IDU consists of a high-brightness backlit Active Matrix Liquid Crystal Display (AMLCD) screen, eight menu buttons, a selection/enter encoder, a display brightness encoder, and an optional slip indicator. The buttons, control

knobs, and optional slip indicator are backlit and adjustable by the brightness encoder. Backlighting may also be controlled by the cockpit master dimming control, depending on the installation.

Remote Sensors:

The Crossbow Technologies AHRS500GA AHRS unit provides attitude and heading reference to the EFIS. The AHRS500GA employs three, solid-state angular rate sensors, three solid-state accelerometers, and three fluxgate magnetometers encased in a single sealed, all-metal housing that is isolated from external shock and vibration. The internal power supply provides 250 ms of standby power in case of a momentary power interruption.

The FreeFlight Systems Wide Area Augmentation System-Global Positioning Sensor (WAAS-GPS) provides GPS data for aircraft, navigation, obstruction, and terrain data in a self contained unit. The WAAS-GPS consists of an antenna mounted on top of the airframe, and a Sensor/Processor Unit (SPU) located remotely in the avionics area.

The Shadin 2000 ADC provides airspeed, altitude, fuel flow, and Outside Air Temperature (OAT) for processing in the EFIS. The ADC is a self-contained remote mounted unit that receives its input from the aircraft's pitot-static system.

The Chelton Flight Systems AIU is a remote mounted unit that converts analog signals from a radar altimeter, an ADF receiver, flight director, marker beacon, and up to two Nav/GS receivers for processing in the EFIS. The AIU also converts digital EFIS signals into analog horizontal deviation, course datum and heading datum signals for autopilot control and external CDI indication. Installation of the AIU is optional.

A complete description of the functions of the EFIS is contained in the Chelton FlightLogic EFIS-SV Pilot's Operating Guide and Reference, Doc. No. 150-045240.

Figure 1: PRIMARY FLIGHT DISPLAY

Figure 2: MULTIFUNCTION DISPLAY

2.0 LIMITATIONS

2.1 GENERAL

The installed EFIS equipment complies with TSO C146a for navigation using GPS and WAAS (within the coverage of a Space-Based Augmentation System complying with ICAO Annex 10) for enroute, terminal area and non-precision approach operations (including "GPS," "or GPS," and "RNAV" approaches).

A. The Chelton FlightLogic EFIS-SV Pilot's Operating Guide and Reference, Document No. 150-045240, Revision B, dated 3/25/02 (or later approved revision) must be immediately available to the pilots. The software version stated on the pilot's manual must match that displayed on the equipment.

B. The EFIS must utilize software version:

Without AIU Installed:

Software version 4.0F-10 or later FAA approved revision

With AIU Installed:

Software version 4.1A-10 or later FAA approved revision

C. Before engine start, verify EFIS power is OFF. Low voltage can cause erroneous initialization of the Attitude Heading Reference System.

D. The airplane must be stationary during and for 45 seconds after power up. This allows the Attitude Heading Reference System to initialize.

E. For IFR operation with a primary installation, the EFIS must include a Primary Flight Display and one or more Navigation displays. For IFR operation with a secondary installation, traditional flight instruments must be installed within the pilot's primary field of view.

2.2 NAVIGATION

A. IFR enroute, terminal, and Instrument approach navigation predicated upon the EFIS is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.

B. Instrument approach navigation must be accomplished in accordance with the approved instrument approach procedures. These procedures shall be retrieved from the EFIS navigational database. Note: Before conducting an instrument procedure, the procedure should be verified by reference to current approved data.

C. Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS or any other type of approach not approved for GPS overlay is not authorized using EFIS GPS/WAAS symbology. Approved approaches are noted by an asterisk (*) before the approach procedure label. For example, to select an approach to Runway 8 at Juneau airport, the following options are available:

*NDB08 (Approved Approach is NDB08)

LDA08

D. WAAS or Fault Detection and Exclusion (FDE) must be available at the Final Approach Fix to continue the approach.

E. During a Non-Precision Approach, the primary instruments are the Course Deviation Indicator (CDI) and the Altimeter. The Skyway provides reference to the approach path and a stabilized approach path from the Final Approach Fix (FAF) altitude to the Missed Approach Point (MAP) reference altitude. The Skyway may descend below the Minimum Descent Altitude. The Altimeter must be used to maintain the appropriate altitudes during the approach procedure.

F. The EFIS is not approved for any navigation that requires True Heading.

G. For IFR operation using GPS and WAAS with a secondary installation, a CDI that can be slaved to the EFIS through an AIU must be installed within the pilot's primary field of view.

2.3 TERRAIN AWARENESS

A. The Terrain Awareness function of the EFIS is not an approved Terrain Awareness and Warning System and does not meet the requirements of TSO C151b "Terrain Awareness and Warning."

B. Navigation and Terrain Separation must not be predicated upon the use of the terrain function.

NOTE: The terrain display is intended to serve as a situational awareness

tool only. It may not provide either the accuracy or fidelity, or both, on which to solely base decisions and plan maneuvers to avoid terrain or obstacles.

C. To avoid unwanted alerts, the Terrain Awareness System must be inhibited when landing at a landing site that is not included in the airport database or when a user waypoint approach has not been selected.

3.0 EMERGENCY/ABNORMAL PROCEDURES

3.1 EMERGENCY PROCEDURES

A. PRIMARY FLIGHT DISPLAY FAILURE:
In a primary installation, in the event of a failure of the Primary Flight Display (PFD), the Multifunction Display (MFD) or Standby Instrument (whichever is installed) will be utilized to complete the current flight.

B. OPTIONAL AUTO-SWITCHING TO BATTERY BUS:
In the event of an electrical power failure, the EFIS will be automatically switched to the aircraft battery bus. The "ON BATT" (amber) annunciator will illuminate indicating that the EFIS is on the aircraft battery.

C. OPTIONAL DEDICATED BATTERY INSTALLED:
In the event of an electrical power failure, a dedicated battery will automatically supply electrical power to the EFIS. The "BATT ARM" (white) annunciator will extinguisher and the "BATT ON" (amber) annunciator will illuminate indicating that the EFIS is on the dedicated battery. The dedicated battery will support the pilot's EFIS for a minimum of one hour.

3.2 ABNORMAL PROCEDURES

Failure of the GPS, AHRS or ADC, singly or in combination, adversely impacts the capabilities of the EFIS. Failure of these components is annunciated visually and audibly. In addition, the EFIS software provides reversionary modes to show as much useful and accurate information as possible in light of the failure condition. The equipment has 8 reversionary modes. Section 2 of the pilot's guide provides detailed information on the reversionary modes. The following sections detail procedures for reversionary modes:

A. PFD FAILURE:
In a primary installation, in the event of a failure of the Pilot's/Co-pilot's Primary Flight Display (PFD) – Press the lower right hand knob on the Multifunction Display (MFD) to display the primary flight instruments on the MFD.

B. PILOT'S ATTITUDE/HEADING FAILURE:
In a primary installation, in the event of the loss of attitude and heading information on the Primary Flight Display (PFD) - Refer to the standby Attitude Instrument for airplane attitude information. The EFIS will continue to display ground track, which may be used in lieu of heading.

C. GPS FAILURE:

GPS failure causes the EFIS to lose GPS updating of aircraft position, ground speed and ground track, and the ability to calculate wind information. In this condition, the EFIS operates in "dead reckoning" mode and continues to provide navigational position, groundspeed, and ground track information based upon the last known wind and current air data and heading. A "NO GPS" caution flag is displayed along with a "GPS failure, GPS failure" voice annunciation. In addition, a "DR ##:##" caution flag is displayed to show the pilot the length of time during which the EFIS has been dead reckoning.

The accuracy of the dead reckoning solution depends upon how closely the actual wind matches the last known wind. It is important for the pilot to realize that, in the event of a wind mismatch, position errors will grow over time and can become large. Because of this, the dead reckoning solution is considered a short-term aid to situational awareness in event of a GPS failure, and should not be used for an extended period of time. The following factors should be considered in assessing the validity of the dead reckoning solution:

1. The length of time during which the EFIS has been dead reckoning. The longer the time, the greater the position error can be. As an example, with a 10-knot wind mismatch, the dead reckoning solution will be in error by 10 NM after one hour.

2. Accuracy of the last known wind computation. During normal system operation, wind is calculated during periods of relatively wings-level flight (bank < 6°). The wind calculation considers TAS, heading, GS and track. Factors that affect these parameters can cause inaccuracies in the calculated wind. The pilot should be cognizant of the following potential error sources:

    - TAS: True airspeed errors can be caused by airframe induced pitot-static inaccuracies, pitot-static system leaks or blockages, and inaccurate outside air temperature readings.

    - Heading: Heading errors can be caused by poor AHRS calibration, carrying iron-bearing materials in proximity to the AHRS, and operation of electric motors or other magnetic field inducing equipment. In addition, for the wind calculation to be accurate, heading must match the vector direction of TAS. As a rule of thumb, if the aircraft is being flown out of balance, the wind calculation should be considered suspect.

- GS: Poor satellite geometry can cause variations in the ground speed reading. Although this parameter is generally reliable, it should be considered suspect when a GPS "Loss of Integrity" exists.

- Track: Poor satellite geometry can cause variations in the track reading. Although this parameter is generally reliable, it should be considered suspect when a GPS "Loss of Integrity" exists.

- Atmospheric wind changes. Actual wind is rarely constant. The pilot should expect large wind changes with changes in altitude or in the presence of significant weather. The pilot should also consider the effect of surrounding terrain upon wind.

Loss of GPS also affects the accuracy of the Flight Path Marker. While the vertical component of the Flight Path Marker is unaffected by a Loss of GPS, the lateral component, which is based upon track and GS, uses the last known wind and can be inaccurate. Unlike the dead reckoning position solution, the effects of loss of GPS on the accuracy of the Flight Path Marker are not cumulative. In particular, the Flight Path Marker remains an accurate tool for maintaining level flight during a GPS failure.

In the event of the loss of GPS - Immediately revert to navigation based on dead reckoning and transition to other navigation sources as soon as possible.

In the event of loss of GPS during an IFR approach procedure at or after the final approach fix and still IMC - Initiate the missed approach procedure.

D. AIR DATA INFORMATION FAILURE:
In a primary installation, in the event of the loss of air data information (Airspeed and Altitude) on the Primary Flight Display (PFD) - Refer to backup Airspeed and Altitude Instruments.

E. AUXILIARY SENSOR FAILURE:
In the event of an auxiliary sensor failure (optional AIU, WX-500 or traffic sensor), refer to the FAULTS menu to determine which sensor has failed. In a failure condition, associated symbology is automatically removed from the display. No action is required from the pilot.

With an AIU failure in an installation where the AIU is providing analog guidance signals to an autopilot, the analog guidance signals will be nulled and the autopilot will maintain a wings level attitude and will no longer respond to EFIS guidance. With ARINC429-capable autopilots, ARINC429 roll steering guidance from the EFIS continues to function.

4.0 NORMAL PROCEDURES

4.1 POWER UP and SELF TEST

- Apply power to the IDU by applying aircraft power and placing the EFIS Master Switch(s) in the ON position.

- System will perform an automatic Self-Test. Passing is indicated by a "Push any Key to Continue" screen. At this time verify that the databases are current. Failure is indicated by a "Bios error," "system not found," blank screen, screen with no image, continual screen resetting (booting) or a "CRC error."

4.2 OPERATION

Normal operating procedures are outlined in Chelton FlightLogic EFIS-SV Pilots Operating Guide and Reference Doc. No. 150-045240 Section 5, "Step-by-Step Procedures."

4.3 DISPLAY ANNUNCIATION / MESSAGES

Caution / Warning / Advisory System is outlined in Chelton FlightLogic EFIS-SV Pilots Operating Guide and Reference Doc. No. 150-045240 Section 2, "System Overview."

4.4 SYSTEM ANNUNCIATORS /SWITCHING

NOTE: Actual switches installed are dependent on aircraft configuration

A. EFIS MASTER SWITCH:
The EFIS Master Switch is a 2-position toggle switch located on the Pilot's instrument panel.

B. "ON BATT" ANNUNCIATOR:
With optional auto-switching to battery bus installed, in the event of an electrical power failure, the EFIS will be automatically switched to the aircraft battery bus. The "ON BATT" (amber) annunciator will illuminate indicating that the EFIS is on the aircraft battery.

C. "BATT ON / BATT ARM" ANNUNCIATOR:
With optional dedicated battery installed, in the event of an electrical power failure, the optional dedicated battery will automatically supply electrical power to the EFIS. The "BATT ARM" (white) annunciator will extinguisher and the "BATT ON" (amber) annunciator will illuminate indicating that the EFIS is on the dedicated battery.

D. TAWS INHIBIT ANNUNCIATOR SWITCH / TOGGLE SWITCH:
The "TAWS INHIBIT" (Amber) annunciator switch, when activated, illuminates and inhibits the visual and audible TAWS alerting functions. The "TAWS INHIBIT" annunciator switch is located near the EFIS displays. This switch may be a toggle switch in which the position of the switch serves as annunciation of activation.

E. AUDIO MUTE SWITCH:
The Audio Mute Switch located on the Pilot's control wheel mutes EFIS active voice alerts.

F. SENSOR SELECT ANNUNCIATOR SWITCHES / TOGGLE SWITCHES (Dual Sensor Installations Only):
A Sensor Select annunciator switch for each dual sensor installation is located near the pilot's EFIS displays. A separate switch is used for each sensor type (i.e. GPS, ADC, AHRS). In an annunciator switch, the sensor selection is annunciated by illumination of the switch (i.e., GPS 1). This switch may be a toggle switch in which case the up position selects the number 1 sensor and the down position selects the number 2 sensor.

5.0 PERFORMANCE

No Change.